growth and moulding of the body became apparent after Marie recognised the disorder which he named acromegaly in 1886. Following these events, Dr. Berman duly notes the discoveries relating to the action of substances formed in the adrenal and pituitary glands by Sir E. Sharpey Schafer, described by our author as "Schaefer, the Scotch physiologist, who has done more than any other living man to stimulate study of the internal secretions." Then follows a mere mention, as if it were a mere minor or parochial event, of the discovery announced by Bayliss and Starling in the Proceedings of the Royal Society for 1904, namely, that the pancreas was set into action by a substance which, formed in the mucous membrane of the duodenum, is carried by the circulating blood to the site of its action.

For Dr. Berman the discovery made by Bayliss and Starling was but a parochial affair of John Smith; for the writer of this notice it is the John Hampden episode leading to a revolution which is transforming the whole field of biology. One has only to turn to the Croonian Lecture given by Prof. Starling at the Royal College of Physicians in 1905 to realise that he was under no delusion as to the revolutionary effect of the discovery of the "hormone" which he named "secretin." He realised that the discovery had revealed Nature's most ancient mode of co-ordinating the action of living units; that a new and potent factor had been placed in the hands, not only of physiologists but also of every man or woman who was working at any department or aspect of living matter—one which gave them a working theory to explain myriads of obscure phenomena. It was the merit of Dr. J. T. Cunningham to apply the new theory to heredity and evolution.

The hormone theory as propounded by Starling in 1905 has had an effect on all branches of medicine—in surgery, medicine, obstetrics, and particularly on psychology. For many thousand years, men of nearly all countries have realised that the removal of the genital glands produces a profound change in the nature and behaviour of all kinds of domesticated animals. The ancient Egyptians must have been aware of these effects. It is the intricate and multitudinous action of hormones on the nervous system which has enlisted the particular enthusiasm of Dr. Louis Berman. In this book he has set out in full detail not only all that can be said in sobriety relating to the *rôle* of internal secretions in regulating behaviour and temperament, but also a great deal which may be true but at present is entirely imaginary. It is with no hint of disrespect that the reviewer suggests that, after all, the unnumbered myriads of nerve cells which make up the brain have something to do with behaviour and personality; the qualities of a man or woman are not determined by internal secretions alone.

The thesis maintained by the author is best given in his own words (p. 23):

> "The life of every individual, normal or abnormal, his physical appearance, and his psychic traits, are dominated largely by his internal secretions. All normal, as well as abnormal individuals are classifiable according to the internal secretions which rule in their make-up. Individuals, families, nations and races show definite internal secretion traits, which stamp them with the quality of difference. The internal secretion formula of an individual may, in the future, constitute his measurement which will place him accurately in the social system."

In the latter chapters of this work Dr. Berman proceeds to explain, on an endocrine formula, great or uncommon figures in history such as Napoleon, Cæsar, Florence Nightingale, Darwin, Nietzsche, and Oscar Wilde. No doubt there is much to be said for many of his contentions, but when we find Napoleon classed as a "pituitary centred, ante-pituitary superior, post-pituitary inferior, with an instability of both, that would lead to his final degeneration," we have to own that the ordinary historian is not likely to find endocrinology as here presented really helpful to him.

We should not do Dr. Berman and his book justice unless we mentioned the vigour of his style. Every sentence has a "punch" in it—indeed the reader often longs for a plain statement of fact. It is a book which compels one to think as well as to criticise.

A. KEITH.

Positive Rays.

Rays of Positive Electricity and their Application to Chemical Analyses. By Sir J. J. Thomson. (Monographs on Physics.) Second edition. Pp. x + 237 + ix pl. (London: Longmans, Green and Co., 1921.) 16*s*. net.

ALL physicists and chemists, with many who, though less directly, are yet no less deeply interested in the subjects opened up by the study of the phenomena of the discharge tube, will rejoice that Sir J. J. Thomson has found time, amid his many preoccupations, to bring out this second edition of his well-known monograph on rays of positive electricity. The output of scientific work is now so enormous that it is difficult to keep pace with it even in one's own special line of study. It would be practically impossible, if it were not for the assistance given by books such as this, ever to come abreast once more of a subject in which one has once fallen behind. In writing this clear and authoritative account of the present state of a subject which he has done so much to develop, Sir J. J. Thomson has performed a real service to science.

Although the intervention of the war delayed for some time the fulfilment of the prophecy made by the author in his preface to the first edition, that the method of positive rays would be of service in connection with important chemical problems, it has since been so signally verified that the scientific world has been shaken, and the distant reverberations have re-echoed even through the columns of the daily press. The discovery, made by means of the positive rays, that the chemical elements are in many cases mixtures of substances of almost identical properties but of different atomic weights is, indeed, one which may well justify the distinguished author of the method of positive ray analysis in his conviction " that as yet we are only at the beginning of a harvest of results which will elucidate the process of chemical combination, and thus bridge over the most serious gap which at present exists between physics and chemistry." In addition, however, to advances of which no one could be completely ignorant, many of us were aware that a considerable volume of research of a less startling, but not necessarily less important, character had accumulated in the eight years which have elapsed since the publication of the first edition of " Rays of Positive Electricity," and will welcome this well-balanced account of the present state of the subject as a whole.

The growth of the subject is indicated by the size of the present volume, which is almost twice that of its predecessor. So much has been added to the text and so many sections have been rewritten, that although here and there a critical reader may detect, by some imperfectly concealed join, that a portion of the old text still survives, the book is to all intents and purposes a new production. It cannot be said that the present volume is quite so easy to read as its predecessor. The subject has grown not merely in size, but also in complexity, and all the author's well-known powers of exposition are required, at times, to guide the reader through the very complicated phenomena of the discharge tube. The journey is, however, lightened by the skill with which the author succeeds in visualising the most abstruse physical phenomena, and is illuminated by the frequent flashes in which, rising from the particular to the general, he links the happenings in his discharge tube with some of the outstanding problems of physics and chemistry. Thus new light is thrown, not only on such problems as the disintegration of metals and the production and absorption of gases in the discharge tube itself, but also on the origin of spectra, the mechanism of ionisation, the varieties of chemical combination, and the structure of atoms and molecules.

An interesting account is given of the various methods which have been evolved for producing and measuring the positive rays, including, of course, the mass-spectrograph employed by Dr. Aston for the investigation of isotopes. It is thus possible to compare the relative advantages and limitations of the different methods. The excellent plates at the end of the volume leave little doubt that, when accurate measurements of the masses of the particles are required, the much greater dispersion which the mass-spectrograph makes possible gives it undoubted advantages over other methods. It is, however, not adapted for the investigation of the intricate phenomena of the discharge itself, and it is mainly to the latter problem that Sir J. J. Thomson has devoted his own researches. The reproduction of some of the author's more recent photographs shows the considerable advance which has been made in the technique of the experiments, while new methods of measuring the plates, indicated in the text, add greatly to the accuracy of the measurements.

In addition to the now well-known parabolas, the author directs particular attention to the existence of numerous other secondary lines of very varied appearance and to the remarkable variations in brightness or " beading " seen on many of the parabolas in the photographs. Considerable space is given to the elucidation of these appearances, and from them the author derives, not only many practical hints for eliminating some of the ambiguities which previously existed as to the nature of the particles to which a given line on the plate must be ascribed, but also much interesting and valuable information as to the processes going on in the discharge tube itself and the mechanism by which the positive rays are produced. It is impossible to pursue the argument in a review, but it forms by no means the least interesting part of the work.

In one respect we fear that the author may unintentionally be misleading his readers, and that is in the statement that the technique of the subject is not difficult. Here we feel that Sir J. J. Thomson is, unconsciously, undervaluing the very exceptional experimental skill which he and his able assistants have shown in this prolonged and difficult series of researches. In particular the electrical method of measuring the rays, which alone seems capable of giving those metrical results which are so desirable for the solution of many of the outstanding problems, has not until the last few months found any successful exponent since the original experiments of the author himself. We can, however, cordially agree that any chemist with the necessary scientific insight, who would take the time and pains required to become master of the method, would find in it a weapon of research of no mean value.

Some misprints, one or two of which may at first sight rather puzzle the reader, occur. The collection of the whole of the plates at the end of the volume is a great convenience, as the same plate is frequently referred to in different parts of the text. One suggestion we should like to offer in this connection, and that is that the author should provide some key to these very beautiful reproductions of his photographs. It is sometimes extremely difficult for one not versed in the art of reading positive ray photographs to pick out the particular lines referred to in the text from the considerable number which often appear on the corresponding plate. We hope that Sir J. J. Thomson may be prevailed upon to make this concession to human weakness when, at some date which cannot be very far distant, he makes a further revision of the book for its next edition.

J. A. C.

Metamorphoses of Insects.

Insect Transformation. By Prof. G. H. Carpenter. Pp. xi + 282 + 4 plates. (London: Methuen and Co., Ltd., 1921.) 12*s.* 6*d.* net.

METAMORPHOSIS in the animal kingdom may be approached from two angles of vision. We may regard it solely as a preparation for the adult condition that follows upon it, or we may consider it from the point of view of recapitulation of racial ancestry. In reality it is the result of the working of both those factors. Among insects, the higher one ascends among the orders of that class, the more the evidence of recapitulation becomes obscured by secondary changes. Divergence in evolution has occurred between the preparatory and final stages of life. The more highly specialised the perfect insects become the more their larvæ degenerate. It is the inert, legless, eyeless, and often headless maggot that gives rise to the highest expression of insect life. The active " intelligent " type of larva, endowed with limbs and well-developed organs of special sense, is destined to produce an imago lower in the scale of evolution than that which arises from the degenerate larva previously mentioned.

In the springtails there is no metamorphosis. In the locust and the plant-bug metamorphosis is clearly evident, although the young are not very different from their parents. Such insects pass through no pupal stage, and their wings are formed externally. In the majority of insects, however, whether they be beetles, butterflies, bees, or flies, the young or larvæ are vastly different from their parents and a pupal stage has become intercalated in the ontogeny. In insects of this kind the wings arise as impushed imaginal buds and reveal themselves outwardly only when the pupal stage is assumed.

In Prof. Carpenter's book we have a lucid account of the various aspects of the above phenomena. It is elementary, but not unduly so, and there are few biologists who will not benefit by assimilating its contents. The author devotes about two dozen pages to describing the essential features of the morphology of an adult insect. These pages contain nothing that is new to the entomologist, but they enable the more general reader to obtain a better understanding of the book as a whole. The following chapter is devoted to the discussion of the metamorphoses of insects with the open type of wing-growth. This is succeeded by a detailed treatment of the higher orders of insects the wings of which develop from concealed imaginal buds. The remaining chapters treat of wingless insects, the significance of metamorphosis in classification, the surroundings of developing insects, and the various problems of metamorphosis.

The author has marshalled his facts into a continuous whole with conspicuous success. He leads the reader, step by step, through the increasing complexities of metamorphosis in what we believe to be their true evolutionary sequence. He attempts no new theories nor does he throw fresh light on existing theories. He prefers to draw extensively upon the results of recent research and show them in their true perspective. The book consequently represents very completely the present-day point of view. The discussion of larval and nymphal stages naturally occupies a large part of a work of this nature. Prof. Carpenter evidently does not concur with Comstock in his use of the term nymph, and rather adopts the definition that applies it to all exopterygote insects when the latter are in a stage in which the wing rudiments can be distinguished clearly by the naked eye. The expression nymph, however, is a conventional one, and in reality all nymphs are, in the zoological sense, larvae.

The book is one which imparts a true appreciation of how the details of the life-histories of different types throw light on the development of insects as a class. It is well printed and adequately illustrated with figures largely borrowed from the writings of contemporaries, or from Prof. Carpenter's own publications. Few scientific works have been issued since the war at so reasonable a price, which is a matter for congratulation to the author and publishers alike.

A. D. IMMS.